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(54) Abstract Title
Beverage dispensing apparatus

(57) A beverage dispense tap handle which can be illuminated by means of a cold cathode fluorescent light using power supplied via a magnetic pick-up. This eliminates the need for wires and contacts in the region adjacent the dispense point. The tap handle is part of a beverage dispensing apparatus having a valved outlet controlled by an actuator 2, the outlet being associated with a magnet 4 which is connected too an electrical source (4', Figure 7), and the actuator being associated with a magnetic pick-up 5, connected to a lighting circuit (5', Figure 7), such that when the magnet 4 and magnetic pick-up 5 are physically separated but magnetically coupled during at least some of the movement to open the outlet, electrical power is inductively transferred from the electrical source (4') to the lighting means 3.

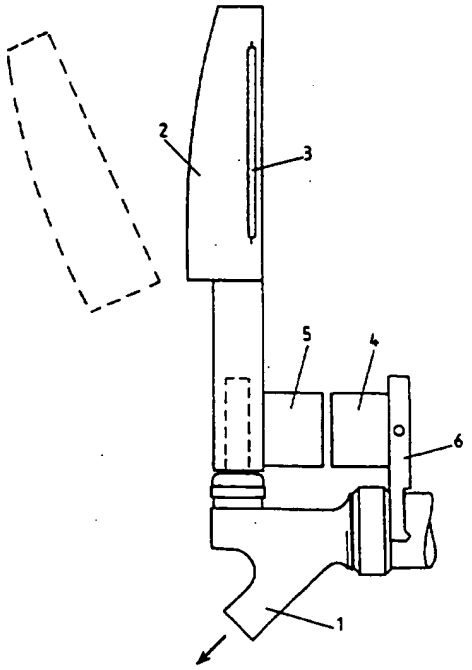

FIG. 5

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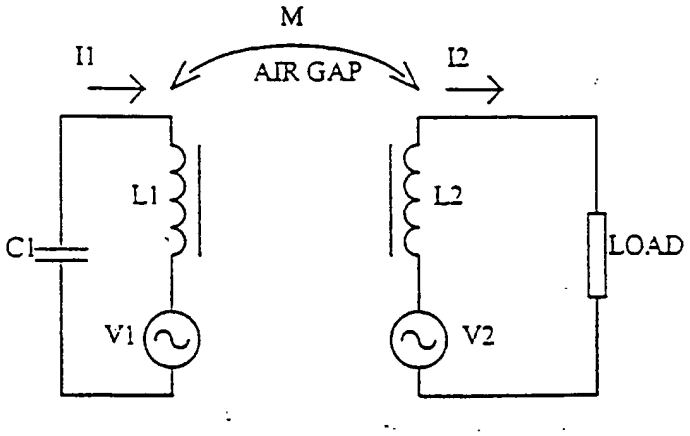
M
I1
AIR GAP
I2
L1
L2
C1
LOAD
V1
V2

FIG. 1

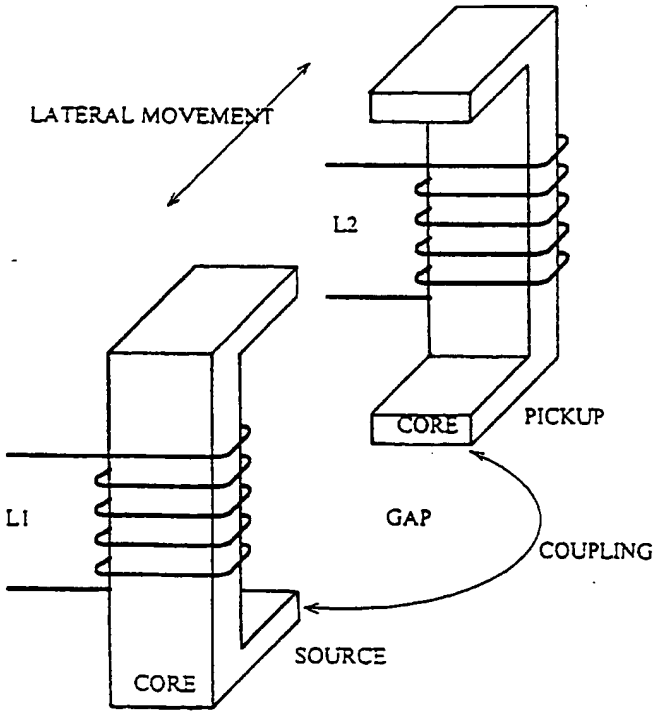
LATERAL MOVEMENT
L2
CORE
PICKUP
L1
GAP
COUPLING
SOURCE
CORE

FIG. 2

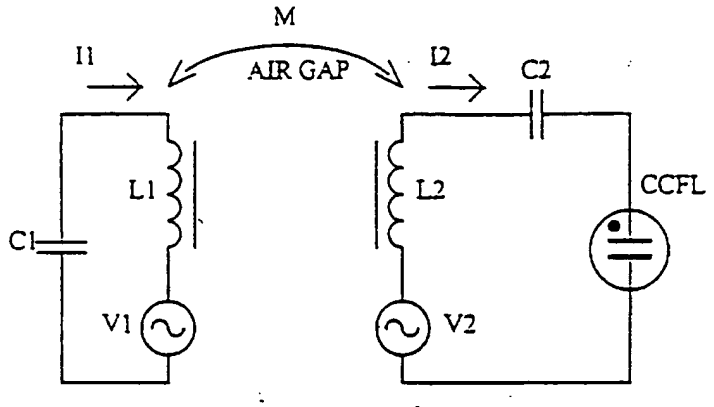

FIG. 3

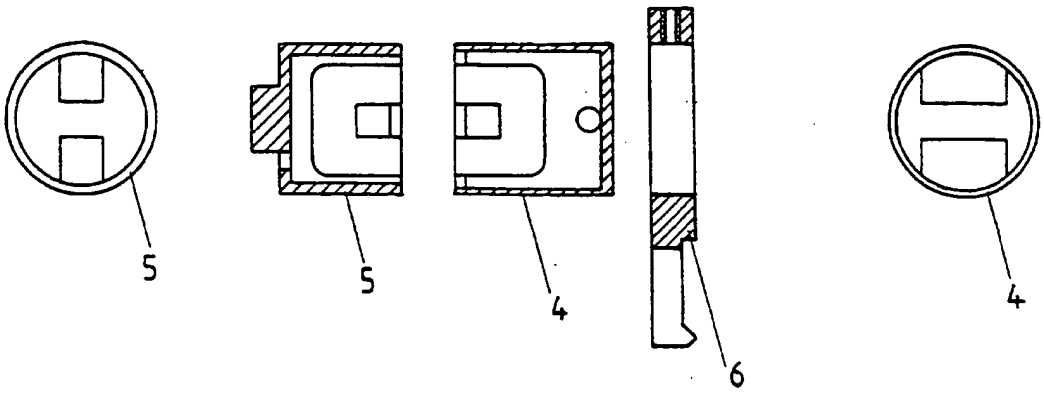

FIG. 4

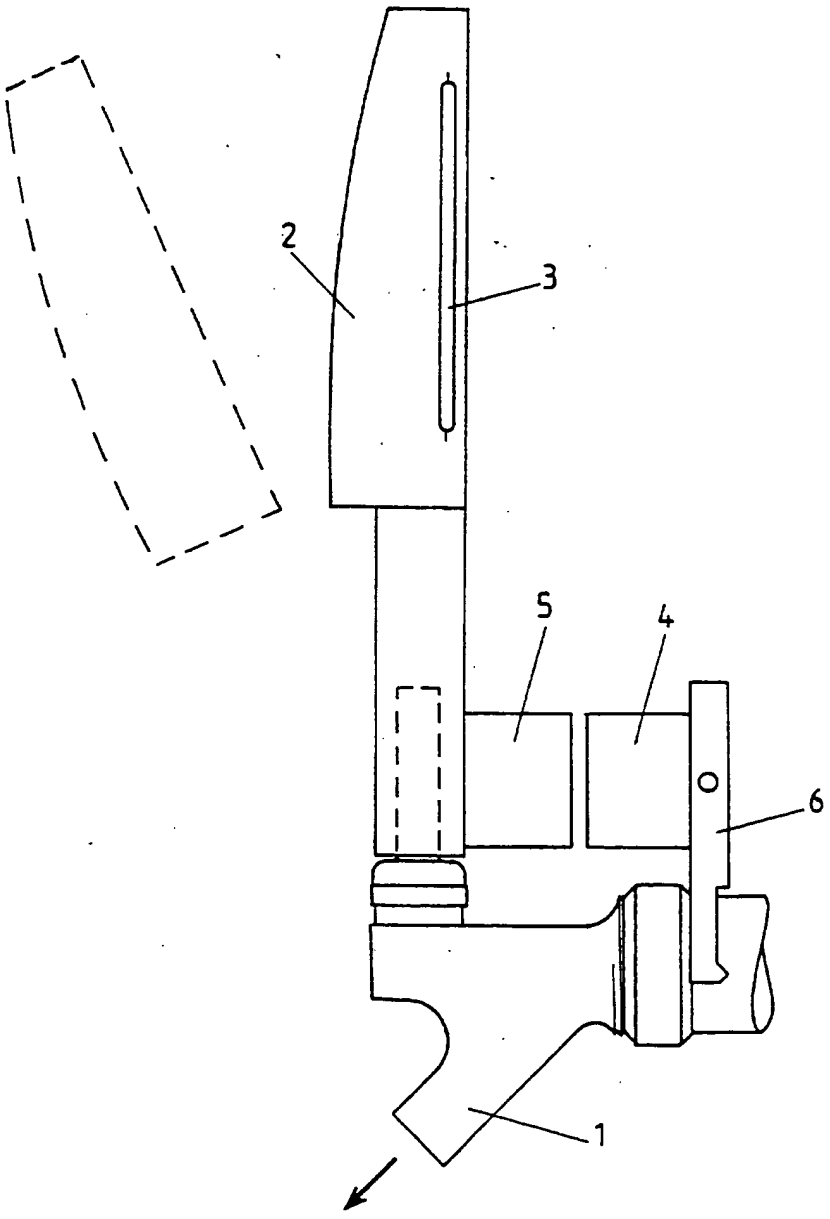

FIG. 5

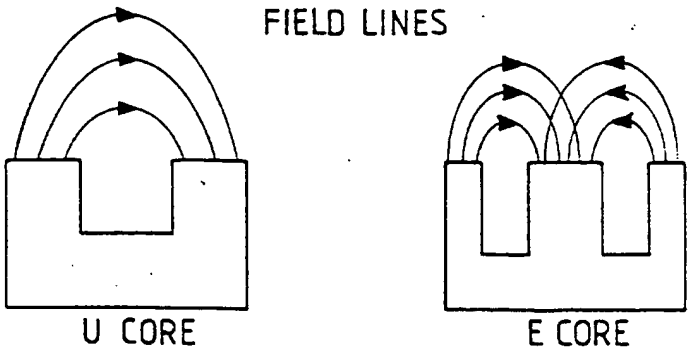
FIELD LINES
U CORE
E CORE

FIG. 6

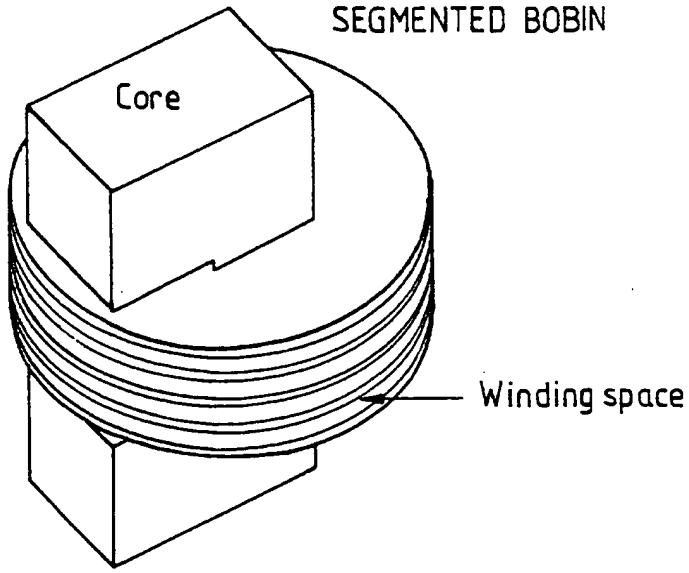
SEGMENTED BOBIN
Core
Winding space

FIG. 8

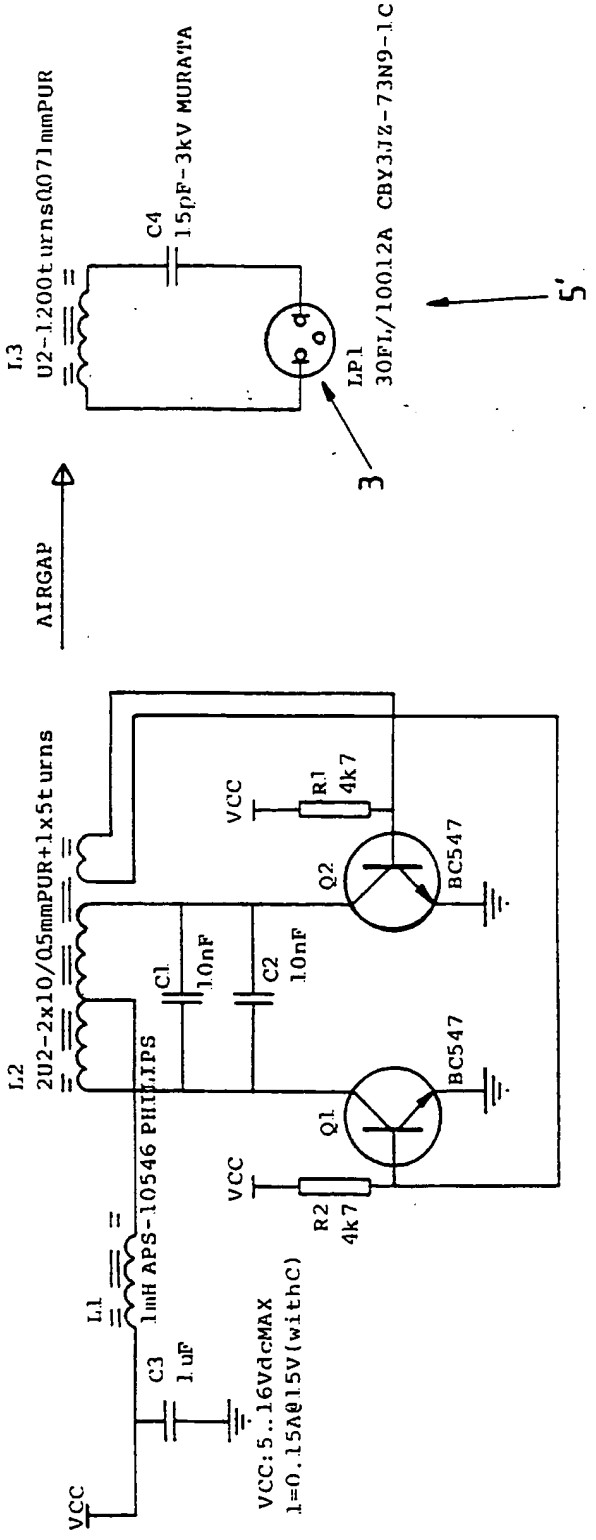
L3
U2-1.200turnsQ.071mmPUR
C4
15pF-3kV MURATA
LP1
30FL/10012A CBY3JZ-73N9-1C
3
5'
AIRGAP
L2
2U2-2x10/0.5mmPUR+1x5turns
C1
10nF
C2
10nF
VCC
R1
4k7
Q2
BC547
Q1
BC547
VCC
R2
4k7
4'
L1
1mH APS-10546 PHILIPS
C3
1 uF
VCC
VCC:5..16VdcMAX
I=0.15A@15V(withC)

FIG. 7

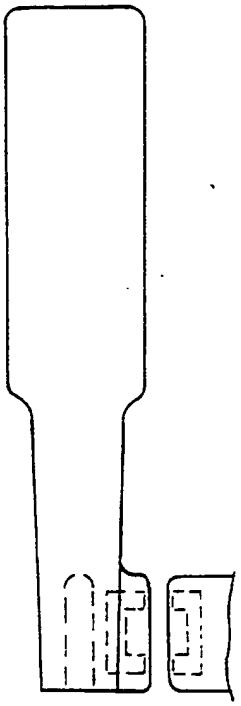

FIG. 9

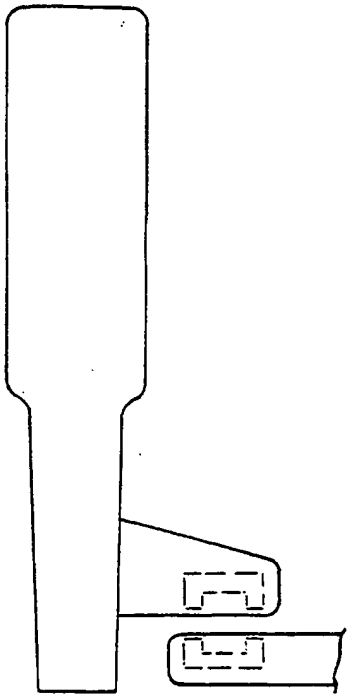

FIG. 10

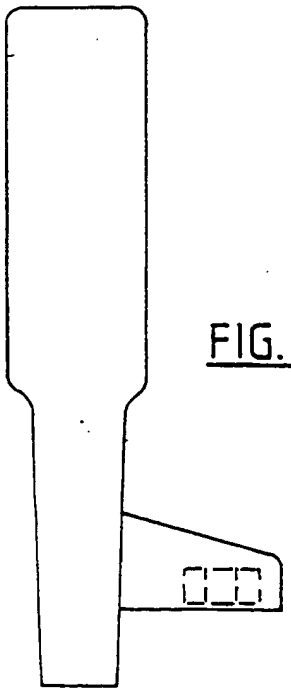

FIG. 11A

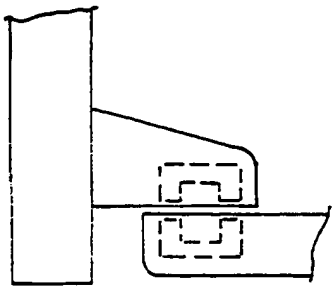

FIG. 11B

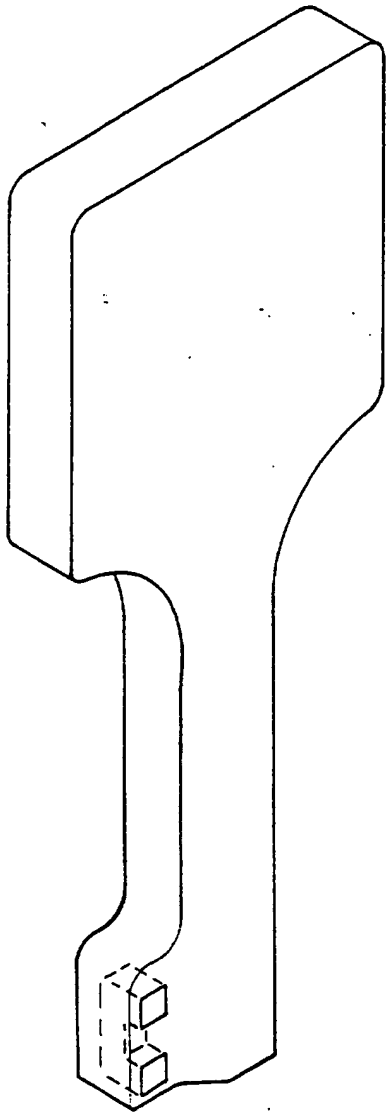

FIG. 12

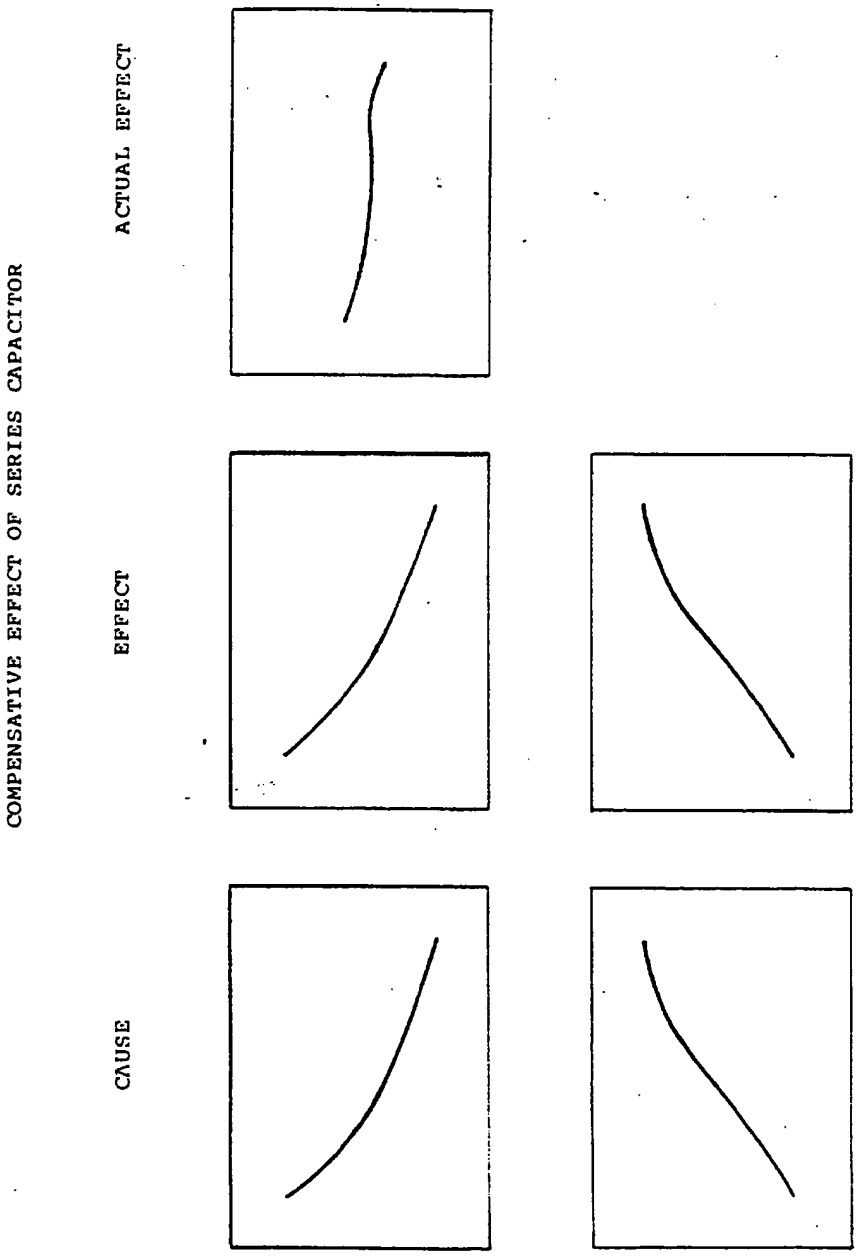
COMPENSATIVE EFFECT OF SERIES CAPACITOR
CAUSE
EFFECT
ACTUAL EFFECT

FIG.13

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Beverage dispensing apparatus

The present invention relates to improvements in and/or relating to beverage apparatus or components thereof.

Dispensing apparatus of a kind that issues a beverage are well known. By "beverage" is meant any drinkable liquid whether gasified or not. Frequently these dispensers take the form of banks of valved outlets, each valve assembly of which is capable of being opened by the movement (sometimes against a bias) of an actuation member. For instance in the dispensing of beers it is not uncommon for banks of upstanding handles to be provided each of which is part of a pivoted or toggled structure (hereafter "pivoted") capable of being moved from a valve opening to a valve closing position and *vice versa.*

In banks of such valved outlets it usual to denote the contents for each valve and this presents an advertising opportunity in addition to the mere provision of identification to the likely user, for example, a bar tender.

We believe it is desirable for such indicia in the handle to be lit but the liquid effected environment leads to complications if normal lighting systems for the handles and/or valves are utilised with great care being needed to ensure that the system can be cleaned without damage or risk.

The present invention therefore recognises the desirability of lighting at least part of the actuator assemblies of such valved inlet type beverage apparatus and it is to this that the present invention is directed. It is preferably to beverage apparatus of such kinds, but not

necessarily restricted to such kinds, that the present invention is directed.

The transfer of electrical power to loads in moving parts or loads physically isolated from the electrical source is often achieved by means of sliding contacts, brushes, and wiring looms. Electrical motors, generators, trains and cranes are typical applications where these techniques are implemented. Disadvantages are however, the wear and tear of moving wiring and contacts, sparking between contacts causing a high risk of failure and hazards.

Transferring electrical power wireless by means of electric fields, such as used in broadcasting, offers an alternative to overcome the above disadvantages. However to obtain adequate power levels for a given load this technique is not desirable due to the need of very high operating frequencies causing many associated problems.
A better alternative can be achieved when using inductive coupling as used in applications such as rotating motors, linear motors, generators and transformers. Motors and generators involves a transfer from electrical in to mechanical energy and visa versa hence a transformer, or at least the principles, is the most obvious technique to transfer electrical power directly to an electrical load.

In most cases a transformer consists of a primary winding connected to the electrical source and a secondary winding connected to a load whereby both windings are tightly coupled by means of a magnetic core.

By physical separation of the primary and secondary, each wound on a magnetic core halve (separated as well), magnetic

coupling is possible across the airgap determined by the separation. In other words electrical power can be transferred across the airgap using two physical separated magnetic devices. For practical reasons however these systems need to operate at much high frequencies to obtain sufficient coupling using special core (magnetic) materials.

In addition, depending on the power requirements and physical constraints of the application, these devices often require relatively complex electronic circuitry in both transmitting (magnetic source) as well as in the receiving part (magnetic pick-up) of the application.

In a first aspect the present invention consists in a valved outlet type dispensing apparatus having at least one valved outlet to allow the egress of a beverage [liquid (gasified or not)] from the valved outlet when the valve is open, and at least one actuator assembly or member (hereafter "member") that directly or indirectly co-operates with the valved outlet to control the opening and closing thereof (whether part of the valve assembly is carried by the actuator member itself or not), the construction and arrangement being characterised in that in use

said valved outlet of the beverage dispensing apparatus has associated therewith magnetic source means driven by a source circuit connected to an electrical source and

the actuator member has associated therewith a magnet pick up means supplying a pick up circuit connected to lighting means requiring an electrical load to provide light from at least part of said actuator,

and wherein the magnetic source means and the magnetic pick up means are physically separated by a distance but are magnetically coupled during at least some of the relative movement to achieve opening such that electrical power is transferred from the electrical source to the lighting means.

Preferably said lighting means is a cold cathode fluorescent light.

Preferably said actuator means is pivoted from preferably a substantially horizontal pivot axis from the dispensing apparatus with the valved outlet.

Preferably the dispensing apparatus and valved outlet is for beer.

Preferably the inductive power transfer arrangement is of a device of a kind hereinafter described by reference to background advice interrelated to such devices and statements of invention referring to such devices.

The present invention also provides an improved or at least alternative inductive power transfer device for transferring electrical power for lighting purposes from a source to a physically and electrically isolated load. In broad terms the invention comprises a split transformer device, whereby the primary winding (magnetic source) is separated from the secondary winding (magnetic pick-up), for transferring electrical power from an electrical source to an electrical load, comprising;

magnetic source means driven by a source circuit connected to the electrical source;

magnetic pickup means supplying a pick-up circuit connected to the electrical load;

wherein the magnetic source means and the magnetic pickup means are physically separated by a distance (preferably variable, eg; as in the aforementioned valved outlet applications where desirably the electric load is to the actuation means to light a display) but are magnetically coupled such that the electrical power is transferred from the electrical source to the electrical load.

Preferably the device is arranged such that the distance can be varied within a given range while maintaining the power transfer (preferably as a result of pivot opening).

Preferably the magnetic source means and the magnetic pickup means each comprise electrical wire wound around a magnetic core.

Preferably the magnetic cores are U cores.

Preferably the cores are of ferrite.

Preferably the source circuit includes a resonant type converter, such as a Royer converter for example, to drive the magnetic source means.

In yet a further aspect the present invention consists in, in a bar, a plurality of beer dispenser handles each of which can be moved from a first condition to at least a second condition which respectively prevents beer flow and allows beer flow and wherein each handle in at least their first condition has at least part thereof illuminated by lighting means in an inductive power transfer pickup circuit.

Preferably each lighting means back-lights and advertising or identification of the beer to be dispensed by the handle.

In still further aspects the present invention consists in apparatus, devices or arrangements in accordance with the present invention wherein the lighting source is a CCFL forming part of a pick-up circuit substantially hereinafter described and preferably where it derives power from a source circuit substantially hereinafter described.

Preferred embodiments of the invention will be further described, by way of example and without intending to be limiting, with reference to the accompanying drawings where:

Figure 1 shows a simplified diagram of the split transformer with primary resonance,

Figure 2 shows a simplified laterally operable inductive power transfer system,

Figure 3 shows the addition of a series capacitor connected directly to the CCF Lamp,

Figure 4 shows the physical construction of the power transfer device,

Figure 5 shows the complete physical construction for a lighted handled,

Figure 6 shows the difference in extended magnetic field of an U core and E core,

Figure 7 shows the complete electronic circuitry,

Figure 8 shows a pick-up core winding a lighted handle,

Figure 9 is a side elevational view of a reduced offset form of device of the kind depicted in Figure 5,

Figure 10 is a different option showing a vertical alignment upon closure of the two circuits,

Figures 11a and 11b are a side elevation view and top view respectively of a different form which has the circuits aligned substantially horizontal (where the handle is vertically upstanding) but has them offset one from the other actually of the arc of handle opening rather than tangentially thereto as in Figure 5,

Figure 12 shows a variation of the arrangement shown in Figures 5 and 9 where preferably the magnetic pick up means of the pick up circuit is set back more on the centre line of the closed handle such that the opening arc of movement thereof tends to reduce the upthrust and reciprocal down thrust of the magnet pick up means during the arc of opening and closing respectively, and

Figures 13 shows by a series of graphs the cause and effects arising from varying (different) parameters and showing the actual effect whereby the pick up circuit of considerable simplicity of the present invention and thus low unit cost can achieve a worthwhile lighting effect over usual operating conditions for the valved outlet arrangements of the present invention.

In each of Figures 4, 5 and 7 the following references have been used.

1. The valve outlet of, for example, a beer tap, the arrow showing the outflow direction that occurs when the handle 2 is in the pivoted out condition shown by the broken lines in Figure 5. The handle 2 is shown in the closed condition in Figure 5.

2. The handle
3. The light source (preferably a CCFL as hereafter defined).
4. The magnetic source means.
4'. The source circuit.
5. The magnetic pickup means
5'. The pickup circuit.
6. Mounting bracket.

The concept of the invention is based on principles of a standard transformed however with the significant difference that the primary winding is physically separated (containing the operating area for the application) from the secondary winding.

By maintaining two core halves such that the magnetic fields are well contained in the lateral operating area, using high operating frequencies as well as using resonant techniques sufficient power transfer efficiencies can be achieved for the application without the need of complex electronic circuitries.

Figure 1 shows a simplified primary resonance inductive power transfer unit. The primary or magnetic source is tuned to a particular operating frequency which increases power transfer, signal purity (low RFI contents) and therefore efficiency.

In many cases, such as in this particular application, the distance or airgap between source L1 and pick-up L2 is not necessarily constant hence the voltage induced in L2 will change due to the variation in mutual coupling. In most cases it will therefore be required that the pick-up voltage supplied to the load is electronically

controlled which can be achieved with special switch mode techniques.

When using a Cold Cathode Fluorescent Lamp such as in this invention the electronic control can be replaced by a single high voltage capacitor in series and connected to the pick-up coil L2 as shown in figure 3 reducing costs dramatically.

Figure 2 shows a simplified laterally operable inductive power transfer unit using U shaped core halves. This figure also shows that the lateral movement is on the same axis as that of the magnetic coupling however depending on various manufacturing requirements many other combinations are feasible.

Figures 4 and 5 show a first preferred embodiment of the invention in which electrical power is inductively transferred power from a source to a light fitting contained within interchangeable drink dispensing handle for illumination of advertising labels for example. The light fitting is preferably a "Stanley" CCFL with 73mm length, 3mm diameter, and three wave length bands although similar products are suitable as well.

A standard dispensing valve with an angular movement (open to closed position) of approximately 20 degrees is able to hold a range of operating handles. The valve is fitted with a transparent handle modified with a grove cut along its length and centre to provide a space for the light and wiring from the light to the pick-up circuit.

The magnetic pick-up is housed in a hollow cylinder shaped case (Case 1) provided with a stud on one side so that the case can be press fitted into the handle as well as a hole for the internal wiring.

The magnetic source and the required electronic circuitry are also fitted in a cylinder shaped case (Case 2) provided with a wiring hole for the dc power inlet. Case 2 is press fitted in a mounting bracket which can be clamped onto the dispenser stand. Both cores, required for the magnetic circuits, are held in place by cover plates press fitted into the cases (1 & 2).

For practical reasons and to obtain minimum air gap changes while operating the handle the above combination is placed at the bottom of the handle, centred along the same axes, leaving a space (air gap) of 3mm when in closed position, as illustrated in Figure 5.

From the above drawing it can be seen that the pick-up case does not turn along the rotation axes of the handle (it moves upwards as well), this is due to the offset caused by the length of the pick-up case (1) and can be improved by reducing the length or keeping the distance of the outside plane (of the pick-up core) as close as possible to the centre of the handle. By minimising the above effect the power transfer can be improved hence mechanical dimensions geometries can be reduced hence core geometries altered.

Preferably all parts are glued and cavities filled with a water resistant epoxy to ensure the whole assembly is water proof.

Pot cores, E cores and U cores can be used for the magnetic circuit. From a manufacturing point of view, Pot and E cores are a better choice since standard coil bobbins can be used however better performance can be achieved with the use of U cores particularly when greater distances are required.

This is mainly due to the fact that the excited field, due to the increased gap between the magnetic poles, of an U core extends farther than a Pot or E core whereby the distance is approximately halved (see Figure 6). One other reason is caused by distortion of field misalignment, and thus reducing the coupling, which occurs when both core halves are moving off centred and not purely lateral as described above.

In practise standard core materials, usually made of ferrite because of good high frequency properties, such as E-cores or Pot-cores can be used which makes the arrangement relatively cost effective.

Preferably a Philips U20 core made of 3C85 or 3F3 material is used.

Preferably the number of turns (N) on the pickup coil is chosen to be as low as possible to ensure that the impedance remains low hence allowing sufficient current to supply the load (in this case the CCFL).

To reduce losses in the core at a maximum DC input voltage of 16 volt, preferably the core area is doubled using two core halves together for the primary (source) coil.

In cases where the power requirements are low and the lateral displacements are reasonably small, the magnetic coupling will be sufficiently high to allow the pick-up circuit to be unturned which simplifies the circuit to a large extent.

The schematic diagram (Figure 7) shows the electronic circuitry built into Case 1 and Case 2. To achieve high efficiency as well as low

RFI content a resonant type converter, in this case a standard Royer Converter, has been implemented to drive the magnetic source. Although any other resonant converter could be used this converter is simply thus reducing manufacturing cost.

The converter converts the dc input voltage into a sine wave on the primary winding L2 (in figure 7) generating an alternating magnetic field at the poles of L2 (magnetic source).

Using $N = \frac{\Pi Vcc.\ 10^9}{4fA_BB}$ where Vcc = input voltage
B = 0.15T (set by core material at 100 Hz)
f= operating frequency (100 Hz)
A_B = core cross sectional area
N = number of turns

A maximum input voltage of 16Vdc, a maximum Bfield of 50mT and an operating frequency of 100kHz a total of 40 turns is calculated from the above equation.

The inductance of the primary can be estimated from equation

$$\approx \frac{N^2 A_B 4\Pi 10^{-7}}{I_g} \qquad 9)$$

Since the area of one core is $56mm^2$ (from data sheet) the combined area of the 2 cores is 112mm and including fringing (gap of 3mm) the actual area will be increased to $190mm^2$. Using this area in equation 9 results in an inductance of 114μH.

Since $\boxed{f_o = \frac{1}{2\Pi\sqrt{LC}}}$ $\boxed{C = \frac{1}{4\Pi^2 . L f_0^{\ 2}} = 22pF}$ 10)

setting the operating frequency to 100kHz.

A low distortion sine wave is maintained when the circulating current through the resonating capacitor and primary winding L2 is larger than the total real current caused by the load and the total losses.

The circulating current can be calculated from

$$I_c = \frac{\Pi.V_{oo}}{\sqrt{2}} .V.C = \frac{V_{oo} .p^2 2f.C}{\sqrt{2}} \quad 11)$$

using the above obtained variables in equation 11 results in a circulating current of 0.45A.

Since sufficient pick-up can be achieved in the arrangement, the pick-up circuitry can remain untuned, as can be seen in Figure 7. The combination of high voltage (ie. high number of turns on the pick-up core) and a small capacitor in series with the load provides a semi current source and maintains constant light current, independent of the working voltage, and ensures a high striking voltage for the CCFL.

The secondary (pick-up) number of turns can be approximated by calculation however due to the complex magnetic geometries the exact number has been obtained experimentally. In practice it has been found that to obtain 1000Vrms at a gap distance of 3mm (closed position), 1200 turns are sufficient.

Due to the complex magnetic geometries, the secondary number of turns have been obtained experimentally. In practice it has been found that to obtain 1000Vrms (in closed position) at a gap distance of 3mm, 1200 turns are sufficient.

The source - pick-up (or transformer) ratio T is therefore approximately

$$T = \frac{V}{V_o} = \frac{V}{V_{oo}\Pi} = 20 \qquad 12)$$

Since the required current for the CCFL on the pick-up circuit is 5mA, the real current through the primary inductor Ip=20x5=100mA (not including losses) which is sufficiently small compared with the above determined circulating current of 0.45A.

The series capacitor C3 can be calculated from

$$C_3 = \frac{I_o}{(V_a - V_o)w} \qquad 13)$$

Where V_a is the CCFL operating voltage of 300V causing C3 to be 12pF.

The series capacitor is relatively small (15pF) therefore stray capacitances, such as inter winding capacitance and capacitance interfering with conductive objects, must be kept to a minimum to reduce power losses. The winding on the pick-up core is therefore wound on a segmented Bobin as shown in figure 8 whereby approximately 250 turns are wound on each segment connected in series to obtain a total of 1250 turns. Besides reducing inter winding capacitance this arrangement also reduces the risk of insulation breakdown significantly.

The emitted light remains fairly constant (within 40%) showing only a minor reduction in brightness while the handle is completely opened (maximum airgap distance). This is while the magnetic source

and pick-up are at such a distance that the combination is not completely loosely coupled and because the lamp is driven through a series capacitor.

Due to the mutual coupling the primary inductance will decrease when the distance of the gap is being increased hence the operating frequency will increase as well as lowering the induced voltage in the pick-up (secondary). Fortunately this has a compensative effect since the lower induced pick-up voltage apparently lowers the lamp current, however the increased frequency will lower the impedance of the series capacitor hence increasing the lamp current.

Since the input voltage is directly linked to the primary of the source the light intensity is directly influenced as well however a satisfactory operating range from 12-16Vdc has been observed causing very low RFI in the produced magnetic fields.

Since no controller or resonant stage are required on the pick-up the system can be produced at very low cost. Using cold cathode fluorescent lights with the benefits of high efficiency, long life time, very low heat dissipation is a further advantage in the application.

Figure 13 for the embodiment of, for example, that of Figure 5 demonstrates for the circuits of the present invention CAUSE, EFFECT and ACTUAL EFFECT. The ACTUAL EFFECT shows the actual lamp current against opening (of the tap) distance which shows a much reduced current fall off to that which would have resulted from the severe pick up voltage fall off with the distance owing the detuning of the coupled circuits from their closed frequency condition

to the higher frequencies upon increased opening distance. These higher frequencies provide higher current flows in the pick up circuit. The cumulative effect is the continual lighting of the desired CCFL.

While the device has been described with reference to a simple capacitor in the pickup circuit and Royer convertor the source circuit, more complex control circuitry could be used.

The preferred embodiments eliminate the need for wires and contacts giving environmental ruggedness while allowing a whole new range of illuminated dispensing handles for industrial designers. To the operators the technology is non-hazardous with no risks of sparks or electric shocks even in presence of moisture environments.

CLAIMS:

1. A valved outlet type dispensing apparatus having at least one valved outlet to allow the egress of a beverage [liquid (gasified or not)] from the valved outlet when the valve is open, and at least one actuator assembly or member (hereafter "member") that directly or indirectly co-operates with the valved outlet to control the opening and closing thereof (whether part of the valve assembly is carried by the actuator member itself or not), the construction and arrangement being characterised in that in use

said valved outlet of the beverage dispensing apparatus has associated therewith magnetic source means driven by a source circuit connected to an electrical source and

said actuator member has associated therewith a magnet pick up means supplying a pick up circuit connected to lighting means requiring an electrical load to provide light from at least part of said actuator,

and wherein the magnetic source means and the magnetic pick up means are physically separated by a distance but are magnetically coupled during at least some of the relative movement to achieve opening such that electrical power is transferred from the electrical source to the lighting means.

2. Apparatus of claim 1 wherein said lighting means is a cold cathode fluorescent light.

3. Apparatus of claim 1 or 2 wherein said actuator means is pivoted from substantially horizontal pivot axis from the dispensing apparatus with the valved outlet.

4. Apparatus of any one of the preceding claims wherein the dispensing apparatus and valved outlet is for beer.

5. Apparatus of any one of the preceding claims wherein the inductive power transfer arrangement is of a device of a kind hereinbefore described with or without reference to any of the accompanying drawings.

6. Apparatus as claimed in claim 1 wherein said distance is variable.

7. Apparatus as claimed in claim 6 arranged such that the distance can be varied within a given range while maintaining the power transfer.

8. Apparatus as claimed in claim 6 or claim 7 wherein the distance varying is by pivoting.

9. Apparatus as claimed in claim 1 wherein the magnetic source means and the magnetic pickup means each comprise electrical wire wound around a magnetic core.

10. Apparatus as claimed in claim 1wherein the source circuit includes a resonant type converter, such as a Royer converter for example, to drive the magnetic source means.

11. In a bar, a plurality of beer dispenser handles each of which can be moved from a first condition to at least a second condition which respectively prevents beer flow and allows beer flow and wherein each handle in at least their first condition has at least part thereof illuminated by lighting means in an inductive power transfer pickup circuit.

12. Apparatus as claimed in any one of claims 1 to 5 or an arrangement as claimed in claim 11 wherein the lighting means or the means to provide light as the electrically isolated load is a CCFL forming part of a pick up circuit substantially as hereinbefore described with reference to Figure 1 or Figure 3 of the accompanying drawings.

13. The apparatus claimed in claim 12 wherein the source circuit is also as depicted in either Figure 1 or Figure 3 of the accompanying drawings.

The Patent Office

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Application No:	GB 9724892.6	**Examiner:**	Roger Casling
Claims searched:	1-13	**Date of search:**	26 March 1998

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Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.P): F2V(VW12),G5C(CFF,CJA)

Int Cl (Ed.6): F16K,G09F

Other: Online:WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
A	GB 2264551 A	(CELLAR SERVICES)	1
A	EP 0253954 A1	(MAGEE)	1

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.